



Photo Credit: MHWirth

# MARINE DRILLING RISER ANALYSIS

.....

## PREPARING OPERATIONAL ENVELOPES FOR SAFE OPERATIONS

KONGSBERG is an independent provider of all types of engineering and analysis services related to risers, umbilicals and wellhead systems.

We are an industry leader in engineering with in-depth knowledge of top-tensioned risers, flexible risers, umbilicals and wellheads from all engineering perspectives. Our strength lays in understanding the physical structures and the operational aspects of the systems that our engineering and analysis services are applied to. Most of our experienced engineering staff have had assignments offshore on both drilling and production rigs, giving valuable insight in the environment and operational aspects of the structures that we provide our services for.

Further, with the large fleet of drilling vessels already equipped with other KONGSBERG solutions and technologies such as K-POS dp systems, HIPAP hydroacoustic systems, Riser Management System and K-IMS information management system, we can provide a unique coupling between design analysis, operational conditions and data collection.



**Marine Drilling Riser Analysis**

KONGSBERG provides complete riser system analysis services for marine drilling risers, wellheads and conductors. Comprehensive knowledge and understanding of the riser behavior results in efficient and reliable riser related operations. Analytical approach and specialized software are used to model the dynamics of the riser operating in diverse environments.

The structural stability of a Marine Drilling Riser relies on the top tensioner system and a proper tension setting at all times. Other constraints for Marine Drilling Riser operations are given by the angles in the top and bottom flexible joints as well as the telescopic joint stroke capacity. The loads, imposed by the marine drilling riser on the BOP and LMRP connectors and the Well System (Wellhead, casings and casing connectors) need to be considered and checked against their capacity.

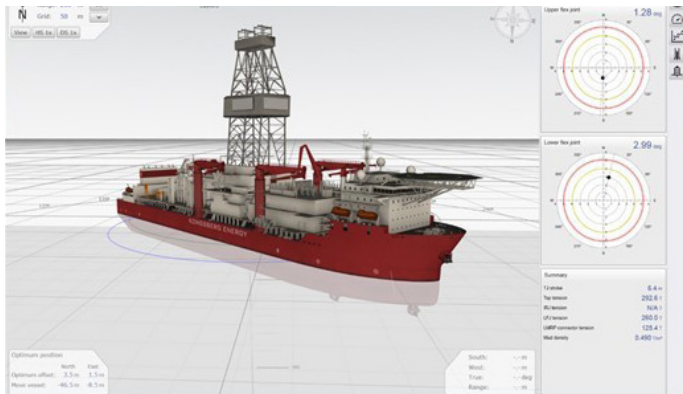
KONGSBERG possess up-to-date specialized analysis tools to predict riser behavior for the expected environmental conditions at the location for the well to be drilled. The Marine Drilling Riser analysis determines the top tension requirements; allowable vessel offsets and predicts the maximum loads in the riser and well system components to be checked against their design capacity.

The analysis covers all operational phases from running and retrieval of the riser, connected drilling and non-drilling operation as well as hang-off. Consequences of unwanted incidents are investigated in special weak point and drift-off analysis.

The following services are offered:

- Drilling riser operability (WSOG)
- Wave fatigue
- VIV fatigue
- Drive off and Drift-off analysis (in coupled time domain with DP trajectories)
- Weak Point analysis
- Wellhead and conductor strength and fatigue analysis
- Riser installation analysis
- Conductor and casing installation
- Hang-off analysis

Normally the riser is discretized into a 3D finite element beam model and a non-linear analysis in the time domain is performed, applying all relevant structural loads as well as environmental loads due to current and waves and vessel motions. All wave loads are applied in accordance with irregular wave modelling.



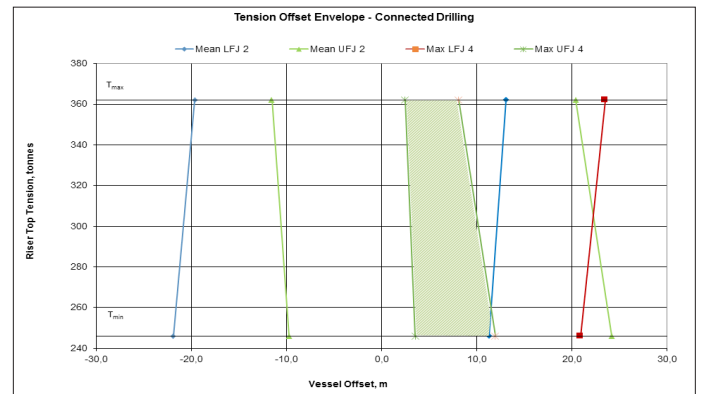
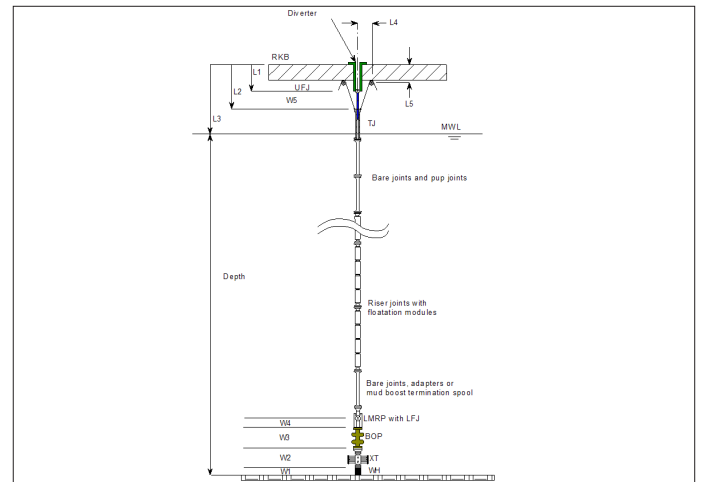
Specifications subject to change without any further notice.

KONGSBERG uses Orcaflex or Riflex for global riser analysis which covers the riser behavior due to waves, current and vessel motions. For Vortex Induced Vibrations response analysis for individual current profiles KONGSBERG uses Shear7 or Riflex/VIVANA.

KONGSBERG possesses a suite of pre- and post-processing routines developed in-house over several years. Some examples are our Fatima-RFC used for RainFlow Counting based fatigue analysis due to dynamic wave response and VivanaLife for VIV induced fatigue analysis. In addition, various in-house post-processing applications are used to extract and transform results from the above mentioned analysis programs in order to perform statistical analysis, graphical results presentations and code checks.

KONGSBERG is the industry leader in Dynamic Positioning (DP) systems for drilling units. In addition, many rigs equipped with Kongsberg DP also have installed the Kongsberg Riser Management System (RMS). The experience gained in managing these systems and their presence on many drilling rigs enables Kongsberg the ability to design, deliver and seamlessly integrate any monitoring system that might be required for critical operations as identified by the preparatory analysis.

By use of the KONGSBERG analytical DP models, state of the art time domain coupled analyses can be performed to establish realistic WSOGs. Once combined with offshore measurement typically through the RMS/WHI data, Dynamic Watch Circles can be established and maintained facilitating improved control of the operation and possibly minimize unnecessary downtime.



March 2016

